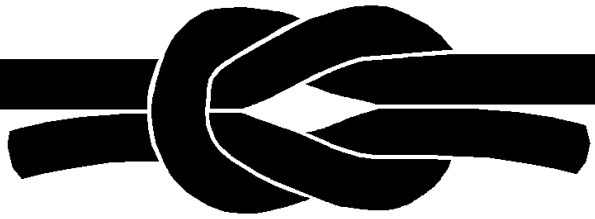
What Knot?

Useful knots for scouting and climbing

Martin Stone



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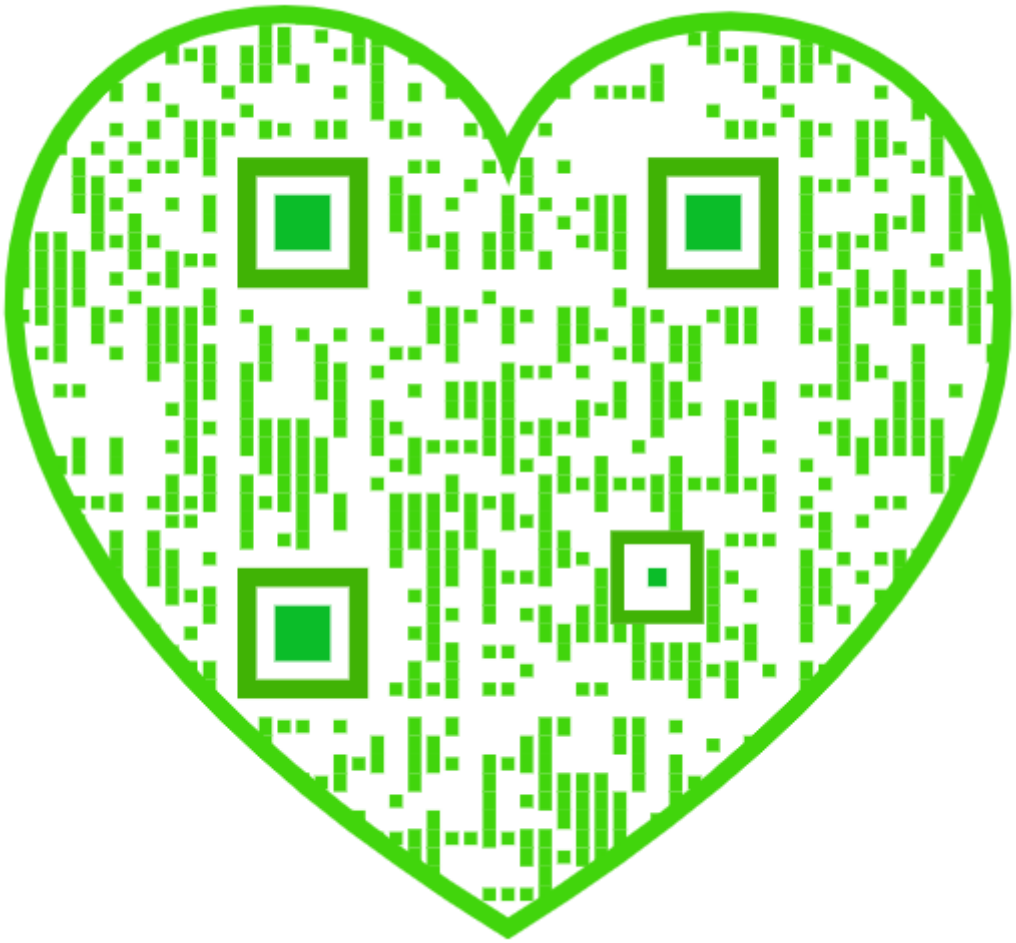

It was tempting to entitle this, "Yet Another Knot Book". Because that is all it is, joining a great many other books, documents, and web-sites available from throughout the world. But what I was looking for was something that had very clear diagrams, was downloadable for local printing, and focussed on knots relevant to Australian scouting activities. Finding nothing that suited, I decided to write it myself. Whether or not I succeeded in these objectives is for you to judge. But in the process I have enjoyed myself immensely. I have always found knots an intriguing, practical, and satisfying pastime. I hope that you do too.

Martin Stone
Hobart
Tasmania
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What Knot?

Binding Knots

Binding knots are tied around objects to hold them together.
Use them for tying a bandage around a limb, clinching a sack closed, holding the wrapping around a parcel, or holding the strands of a rope together.

- **Reef Knot** **5**
- **Surgeon's Knot** **6**
- **Constrictor Knot** **7**
- **Simple Whipping** **8**

Bends

Bends are to join two ropes together.
Use them for lengthening a rope by joining two shorter ones, or for joining the two ends of a rope to make a loop.

- **Sheet Bend** **10**
- **Double Fisherman's Knot** **12**
- **Hunter's Bend** **13**
- **Tape Knot** **14**

Loops

Loop knots are for making one or more loops in the end of a rope, or along its length. Unlike a noose, a loop does not become smaller under stress.
Use them for tying a rope around your waist, to create an attachment point along a rope, or to make a loop to lob over a bollard.

- **Bowline** **15**
- **Double Figure Eight** **16**
- **Alpine Butterfly Knot** **17**

Hitches

Hitches are to secure a rope to a fixed object.
Use them for tying a rope to a tree, or to a spar when starting or finishing a lashing, or to secure a load to a trailer, or to tie onto another rope under tension.

- **Clove Hitch** **18**
- **Round Turn and Two Half Hitches** **20**
- **Rolling Hitch** **21**
- **Truckies' Hitch** **22**
- **Prusik Knot** **24**
- **Munter Hitch** **25**

Splices

Splices are knots woven into the strands of laid multi-strand rope.
Use them for tying a loop, a bend, or a stopper knot that needs to be neat, strong, and permanent.

- **Eye Splice** **26**
- **Short Splice** **28**
- **Back Splice** **30**

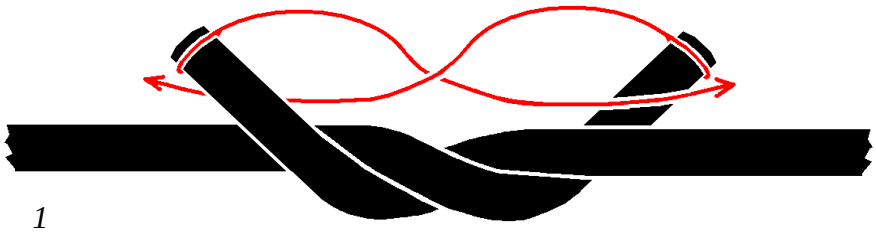
Other Knots

There are lots and lots of knots. Here are a few more.

- **Overhand Knot** **32**
- **Sheepshank** **34**

Reef Knot

Important general-purpose binding knot



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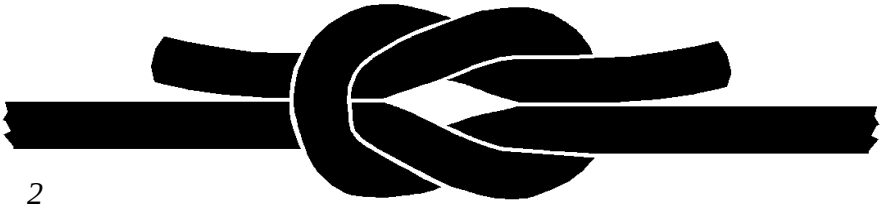

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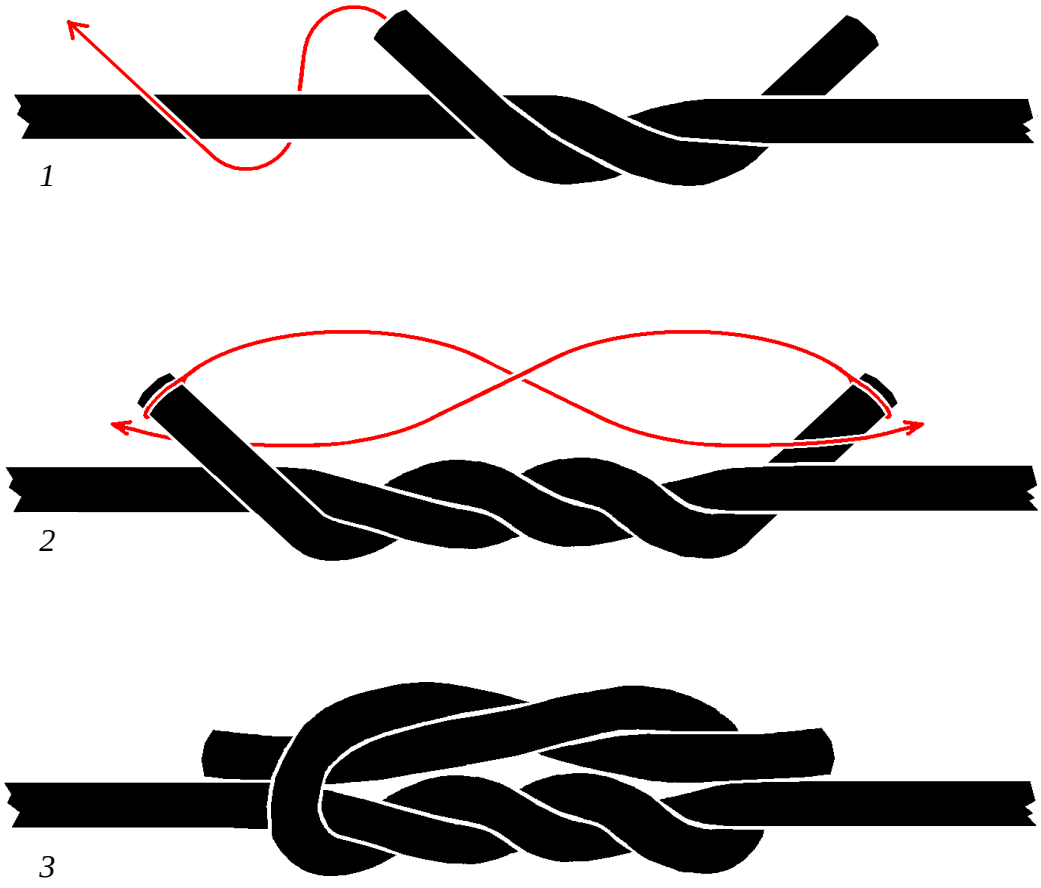
- Used for joining two ends of a rope that is bound around or supported by a solid body, eg tying up a parcel, or securing a bandage or a sling in first-aid.
- Is easily spilled. This is why the Reef Knot should never be used as a bend (to join two ropes). However, this can be an advantage for quickly and gently removing bandages or slings in first-aid.
- Can be hard to untie when wet or tight.
- Not suitable to join artificial-fibre rope or ends of uneven thickness. (The Surgeon's Knot is better for artificial-fibre rope).
- The finished Reef Knot is symmetrical; this is a useful visual check to ensure that you have not tied the much weaker Granny Knot by mistake.
- The Reef Knot was so named because it was used to bind ("reef") sails to the spars of sailing boats, (using short lengths of rope called "reef-lines").
- Also called the Square Knot when used for macrame and decorative knotting.

Surgeon's Knot

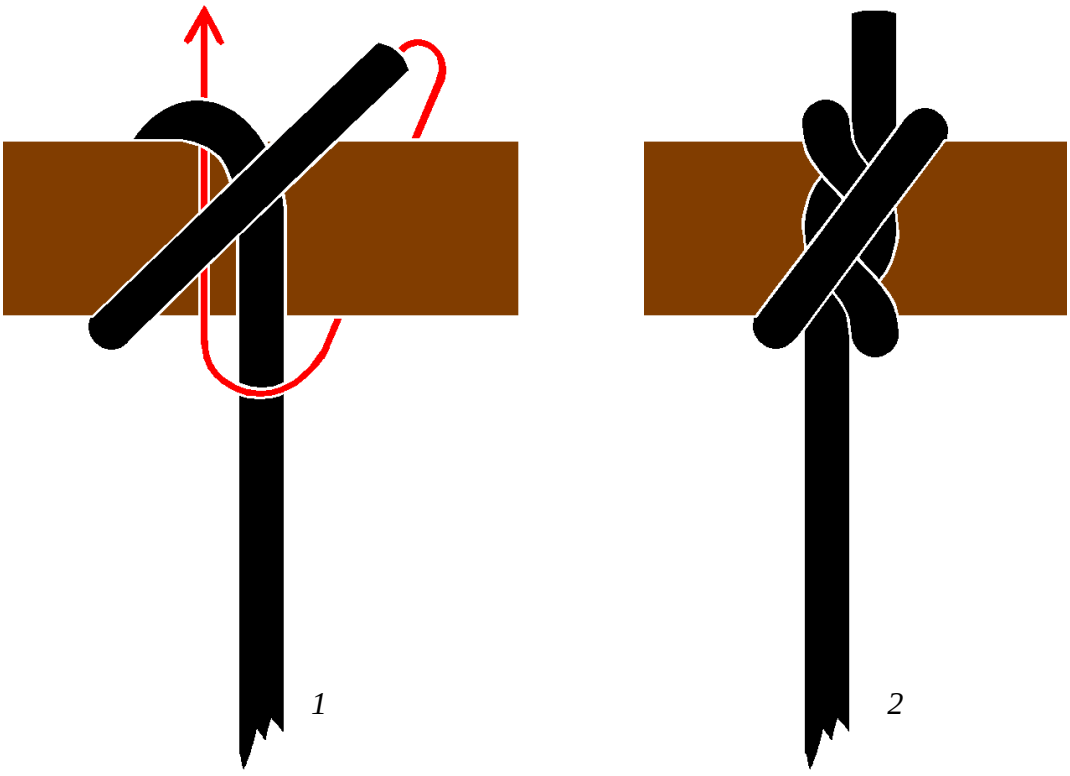
A binding knot for slippery or artificial-fibre ropes



- Used for joining two ends of slippery or artificial-fibre rope or twine that is bound around or supported by a solid body, eg tying up a parcel, or completing a lashing around spars.
- Is more secure than a Reef Knot for slippery or artificial-fibre rope.
- Is easily spilled, so it should never be used as a bend (to join two ropes).
- Can be hard to untie when wet or tight; (surgeons usually snip the stitch rather than untie it).
- The finished Surgeon's Knot is somewhat symmetrical; this is a useful visual check.
- The Surgeon's Knot is so named because it is used by surgeons to tie the ends of stitches (sutures).

Constrictor Knot

Useful general-purpose binding knot



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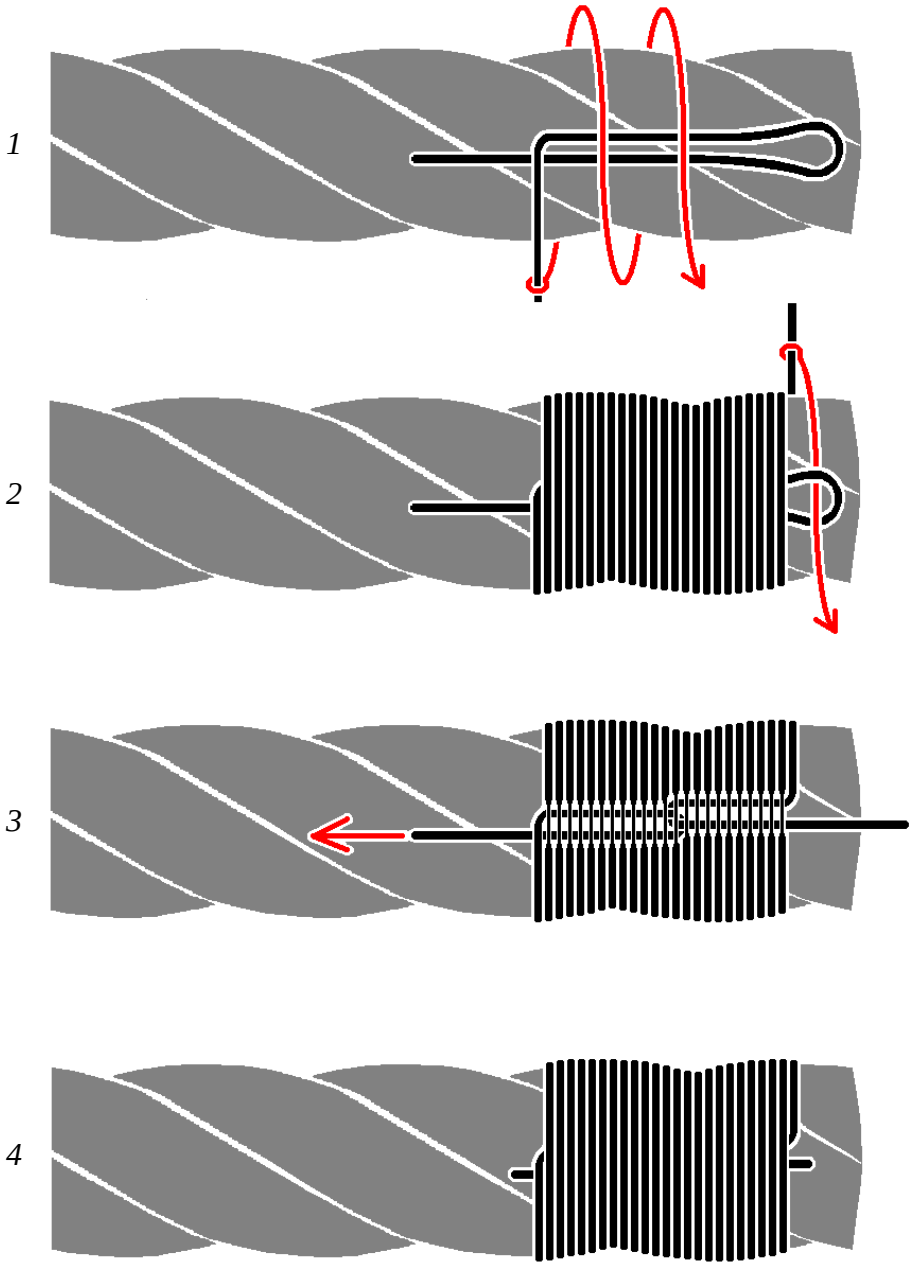
- Used for securely binding the mouth of a bag, or as a quick whipping, (eg to stop a rope from fraying, or to hold strands together at the base of a splice or multi-strand knot).
- Very hard to untie, especially when wet or tight. (That is its virtue!)
  It is usually intended to be cut off (or left permanently), rather than untied.
- Visually similar to a Clove Hitch, but with an extra tuck when tying. In fact, it serves as an excellent hitch that is unlikely to come untied accidentally.
- Should never be used for bandages; it is too easy to tighten, and too hard to loosen.
- Named after what it does best, (ie like a boa constrictor).

Simple Whipping

Important special-purpose binding knot

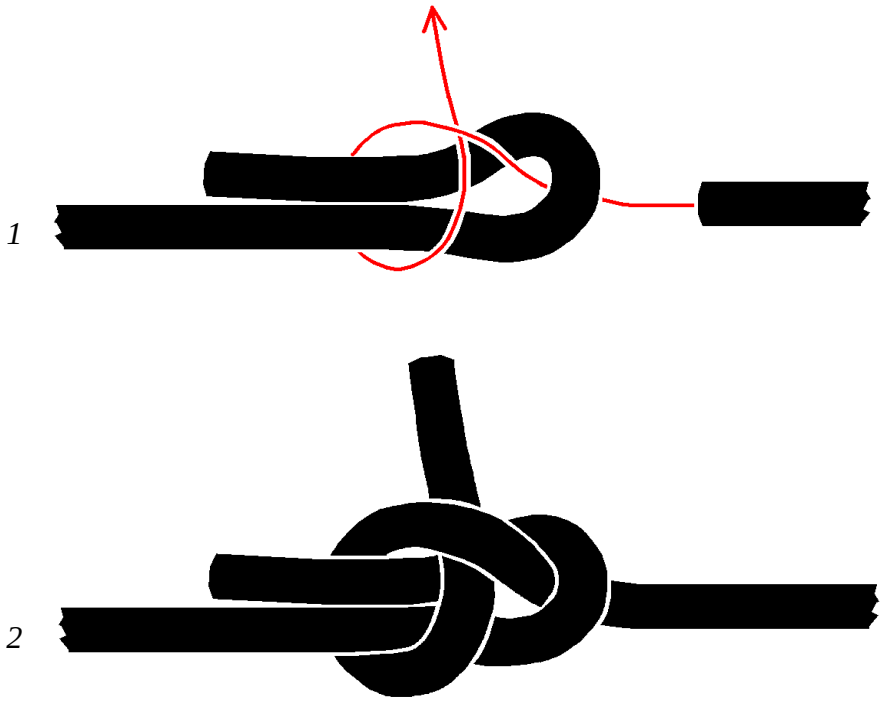


- Used to prevent the end of a rope from fraying. Usually intended to be permanent.
- Particularly useful for the ends of natural-fibre robes; (the ends of most artificial-fibre ropes are usually melted together in a flame or cut with a red-hot blade). However, whipping is recommended for large-diameter artificial-fibre ropes.
- The twine used to tie the whipping should be significantly thinner than the rope it is tied around. It should be strong and have lots of friction; natural-fibre is best, especially if it is tarred or waxed.

- A frayed rope should be re-laid before being whipped.
- The turns of the whipping should be bound tightly and closely together around the rope.
- To complete the whipping, the interlocked loops of twine are drawn down underneath the turns *(3)*. Once tied, the ends of the whipping twine are trimmed off.
- The whipping should be at least as long as the rope is thick. To prevent it being pulled off, the whipping should finish a little distance before the end of the rope.
- Whilst a Back Splice or stopper knot (eg an Overhand Knot) can be tied quickly and without twine, a whipping is usually preferable. A whipped rope-end can be more easily threaded through a pulley or an eyelet (eg in a tarpaulin), and does not snag when tying knots or resolving a tangle.
- Also known as the Common, Plain, or Ordinary Whipping.

Sheet Bend

Important general-purpose bend



- Used for joining two ropes together.
- Good for natural-fibre rope, (strong and easy to untie, even when wet and tight).
- Suitable to join ropes of uneven thickness.
- Ideal to tie a rope to an existing loop (eg in the corner of the tarpaulin), or to a bight (eg for making a net or a Parisian Baudrier -- a makeshift chest-harness), or to an eye-splice (eg in the bottom corner of a flag).
- Make the loop first, and thread the other end through to complete the knot. This is the opposite of the way the Bowline is tied, (which is identical in structure).
- If one rope is stiffer, thicker, or already in a loop (eg an eye splice), then this rope should be used to form the initial bight, (through which the other is then passed).
- Both ends must protrude from the same side of the knot; (otherwise the knot is weaker and can spill).
- The Sheet Bend tends to loosen and spill, particularly in artificial-fibre ropes and/or if the ropes flap around and are not under strain. To minimise this risk, each end can be tied off around its standing part using a single or double Overhand Knot. (These will not come under any strain, so are readily untied later).
- Because of this risk of spillage, the Sheet Bend is not recommended for climbing, abseiling, or caving.

- For extra strength, or if the difference in rope thickness is significant, use a Double Sheet Bend, (see *3,4* below).

- The Sheet Bend was so named because it was used to tie the “sheet”, (the rope which secures sails on a boat).
- Also called the Weavers Knot.

Double Sheet Bend

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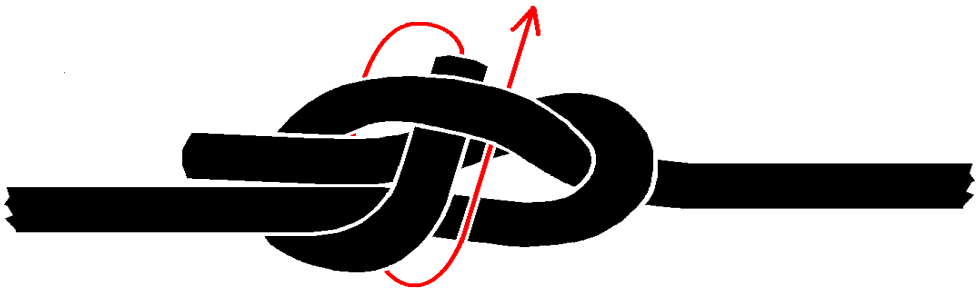

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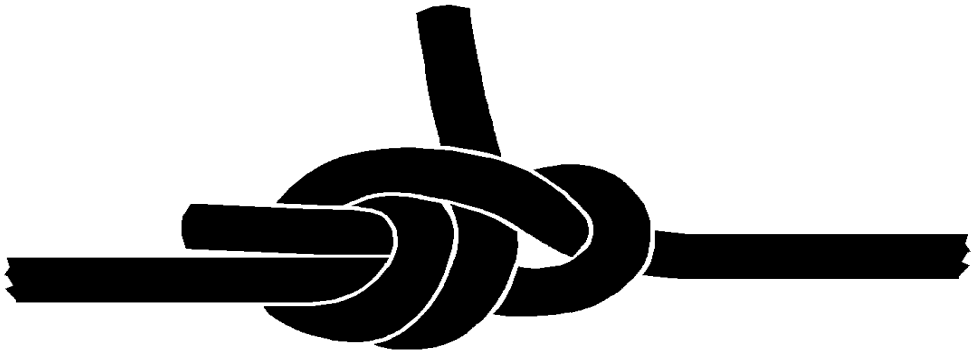
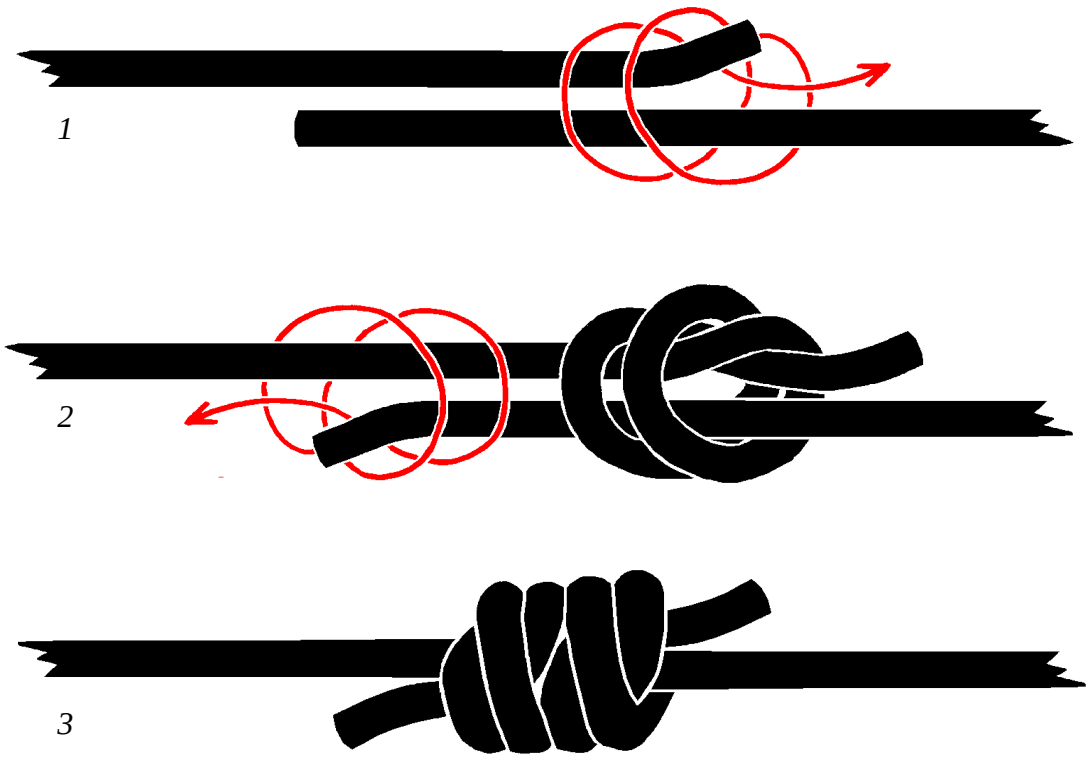


Double Fisherman's Knot

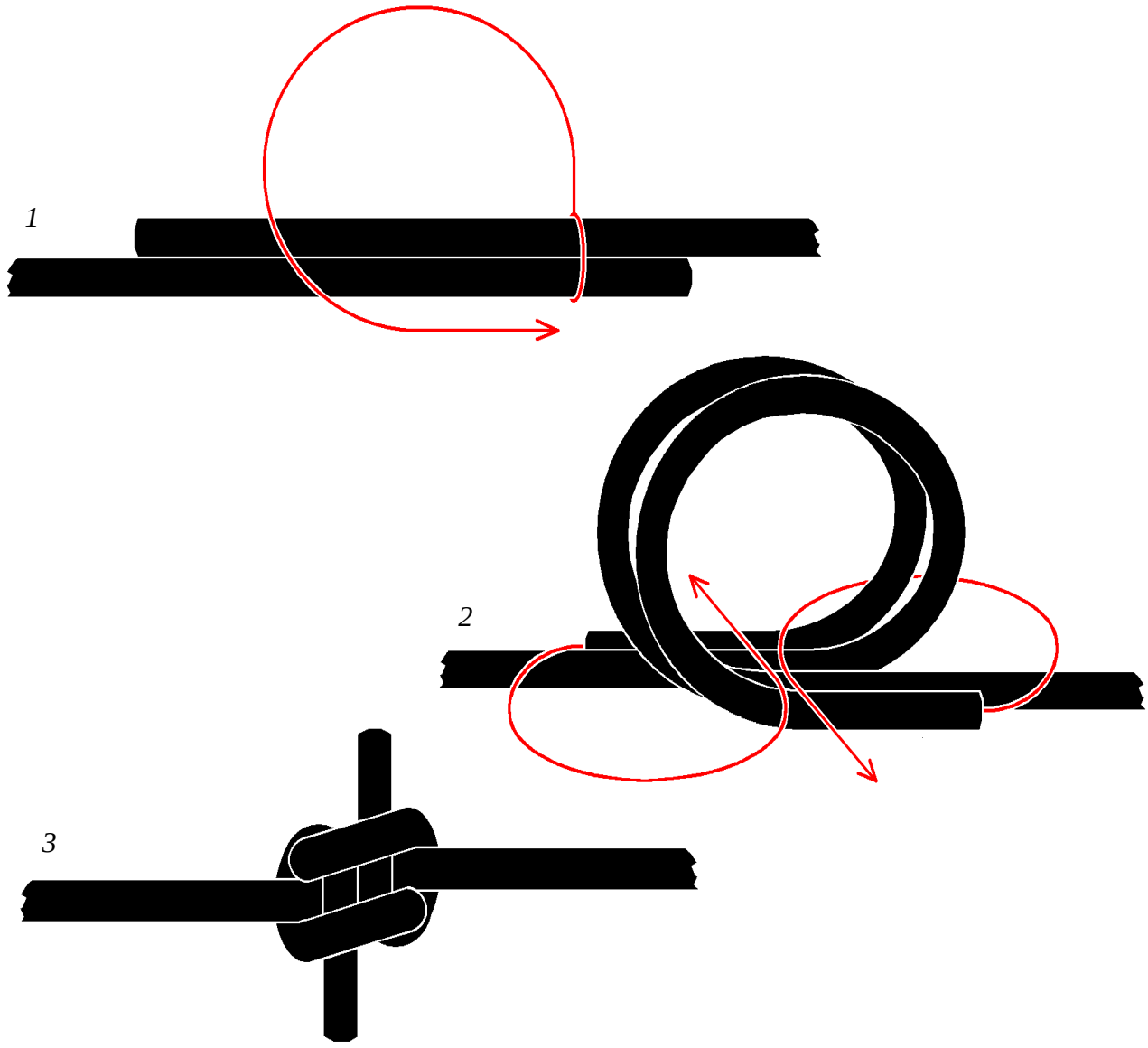
Important special-purpose bend



- Used for joining two ropes together, and is especially recommended to join climbing or caving ropes.
- Excellent for both natural and artificial-fibre ropes, whether smooth-woven or laid, wet or dry. Hence its original use by fishermen.
- Once tightened, this knot will never spill, so it is very secure. However, during tightening the ends can pull through the knot, so generous ends should be left protruding when tied.
- When joining smooth (kernmantle) ropes, it is almost always possible to untie this knot, even after considerable loading.
- Relatively bulky, and uses lots of rope, (but well worth it).
- Suitable to join ropes of uneven thickness.
- In structure, the Double Fisherman's Knot is composed of two Double Overhand Knots (or Blood Knots), each tied around the other rope.
- So-named because of its use to join fishing lines. Also called the Grapevine Knot.

Hunter's Bend

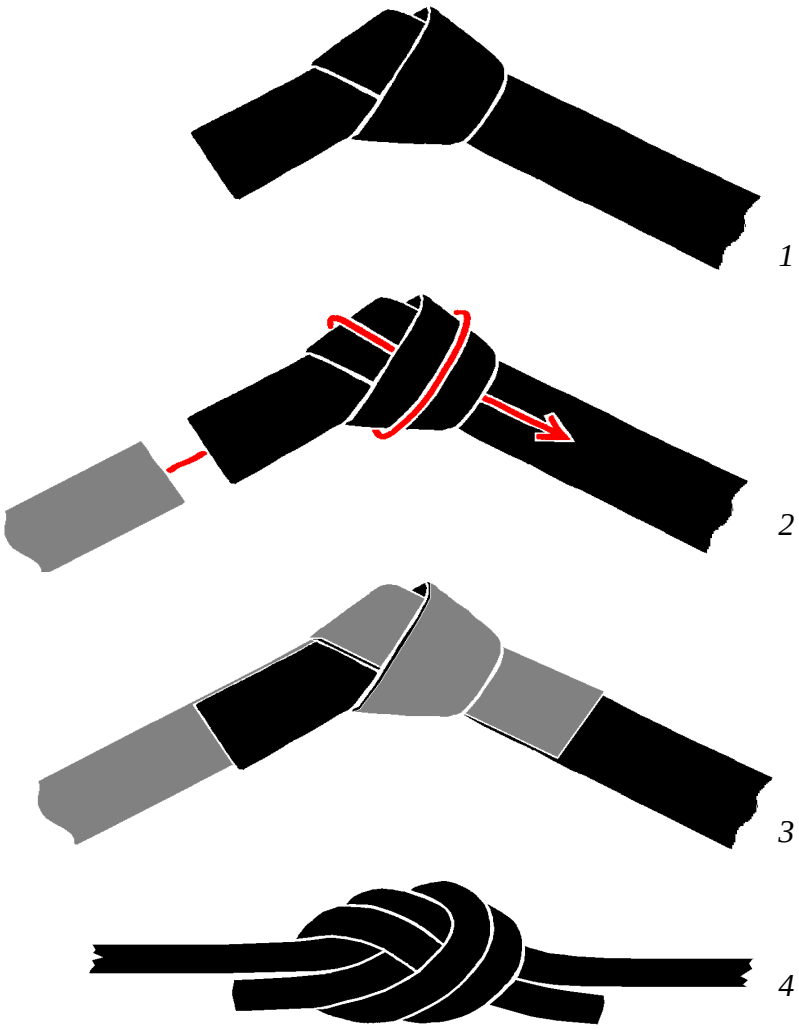
Interesting general-purpose bend



- Used for joining two ropes together.
- Good for slippery cord or light artificial-fibre rope.
- Once tied, Hunter's Bend needs to be carefully "worked" before it assumes its final symmetrical form.
- Hunter's Bend was named after the man credited with (re-) discovering it. Possibly originally known as the Rigger's Knot.

Tape Knot

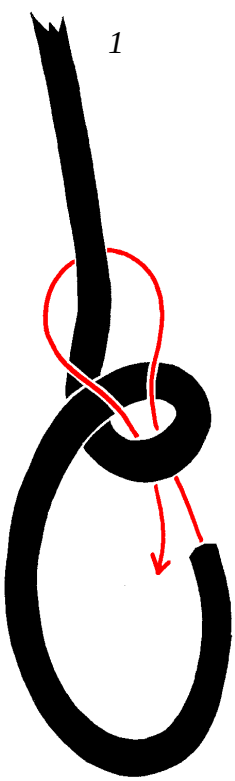
Important special-purpose bend

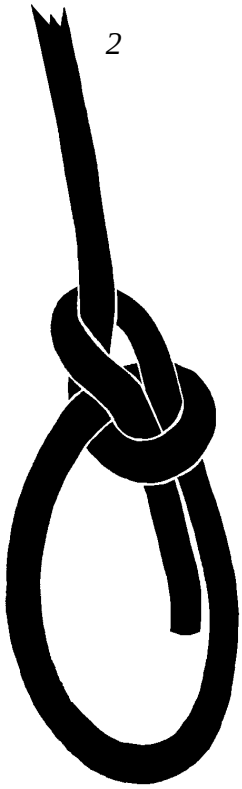


- Used for joining two artificial-fibre webbing tapes or belts together, particularly for joining slings when climbing and caving.
- Can be used to join ropes (instead of tape), for which the knot is very secure but almost impossible to untie if wet and tight.
- Structurally, it is simply two interlaced Overhand Knots.
- When tying, the tapes should not be twisted; their surfaces should be kept flat against one another for maximum friction.
- The Tape Knot is so named because rock climbers haven't got much imagination.
- Originally called the Ring Bend or Water Knot when tied in rope or cord by seamen or fishermen.

Bowline

Important general-purpose loop

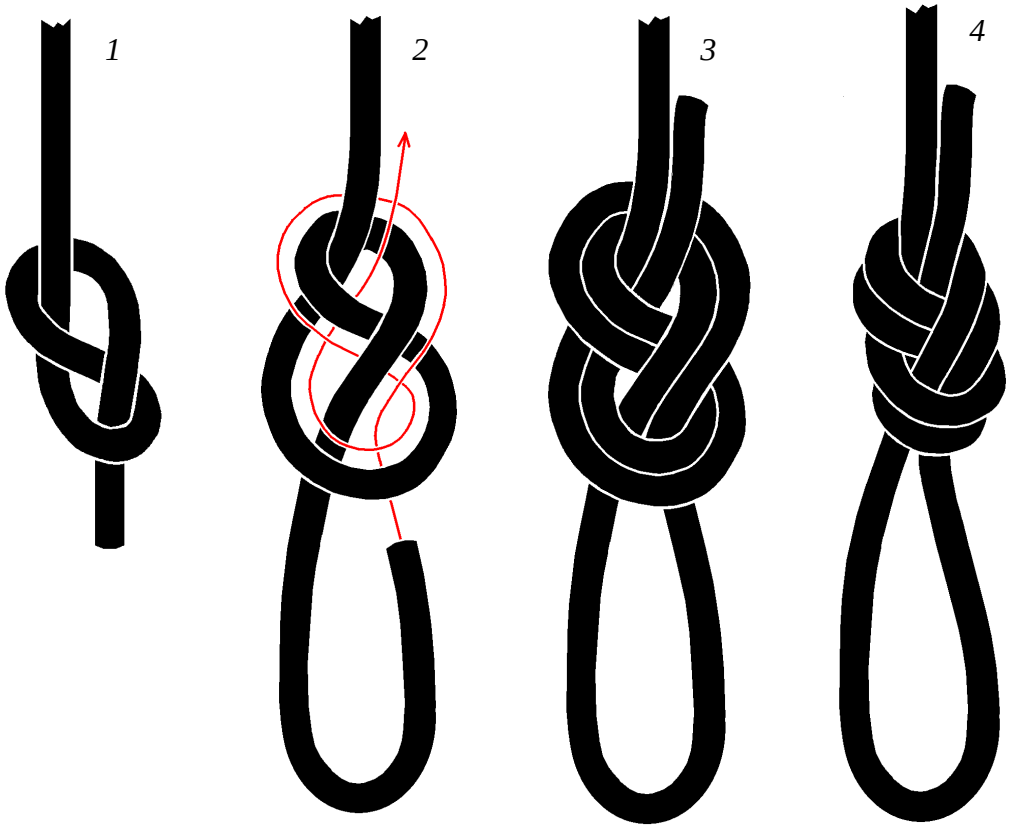




- Used to make a single loop in the end of a rope.
- Good for both natural-fibre and artificial-fibre rope; strong and easy to untie, even when wet and tight.
- Widely used for boating, and suitable for climbing.
- Make a loop first, then thread the end up through the loop, around the main rope, and back through the loop. (Or, as explained to generations of scouts, "the rabbit comes up out of his hole, around the tree, and back down his hole"). This is the opposite of the way the Sheet Bend is tied, (which is identical in structure).
- When complete, the end must protrude within the loop, not on the outside of it. The latter form makes the Cowboy's Bowline, which is less secure.
- The Bowline can loosen and spill, particularly in artificial-fibre rope and/or if the rope flaps around and is not under strain. To minimise this risk, the end can be tied off around the closest part of the loop, using a single or double Overhand Knot. (This will not come under any strain, so is readily untied later).
- The Bowline was so named because it was used to secure the "bow line" rope to old square sails.

Double Figure Eight

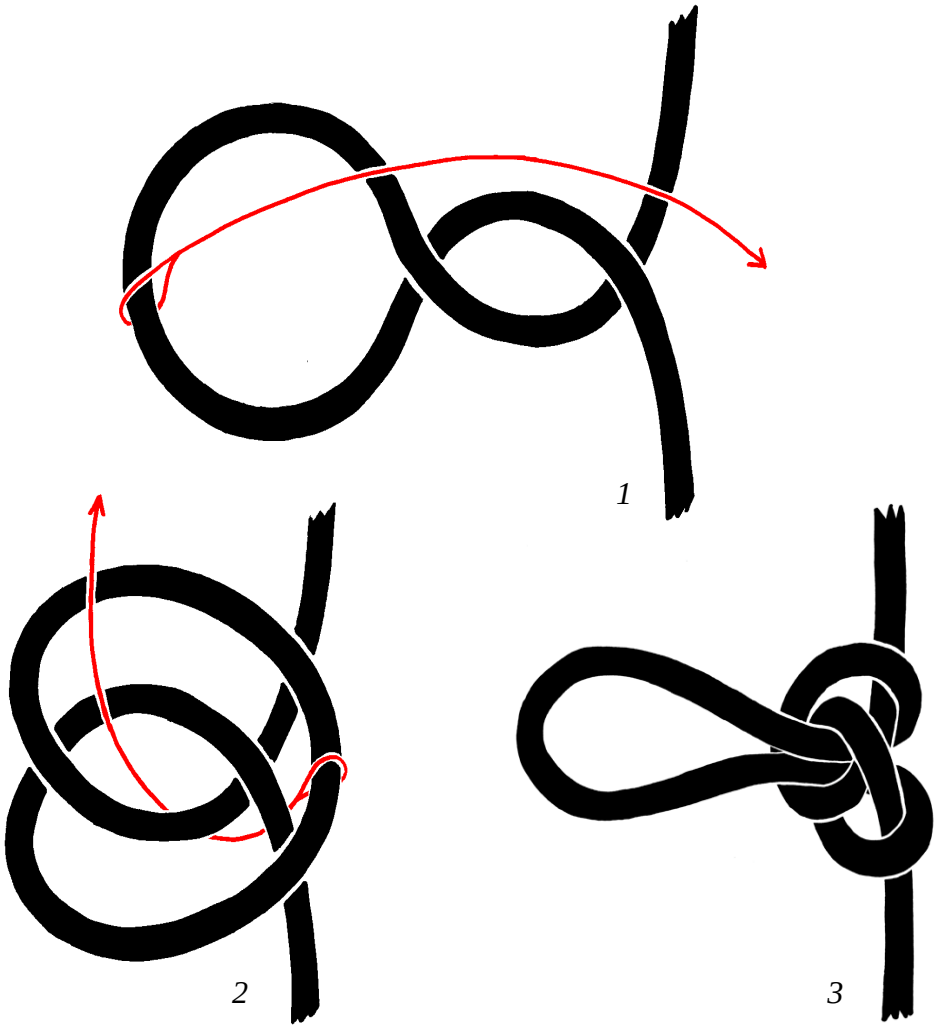
Important general-purpose loop



- Used to make a single loop in the end of a rope, or to make a loop some way along a rope.
- Good for artificial-fibre rope; strong and easy to untie, even when wet and tight. Can be hard to untie in natural-fibre rope.
- Particularly suitable for climbing and abseiling.
- The Double Figure Eight can be tied in two ways:
  - Either tie a Figure Eight (*1*) with a single thickness of rope (well back from its end), then reave the end back along itself to double the original knot (*2*). This is how you tie the loop onto a harness or a fixed object;
  - Or double the end of the rope, then tie a Figure Eight with the doubled loop.
- The Double Figure Eight can loosen and spill in artificial-fibre rope. To minimise this risk, the end can be tied off around the standing part of the rope, using a single or double Overhand Knot. (This will not come under any strain, so is readily untied later).
- Whilst often used to tie a loop some way along a rope, the Double Figure Eight is not appropriate for situations where a 3-way pull is possible. (The Alpine Butterfly Knot is best for this).
- The Double Figure Eight was so named because of its symmetrical shape, by which users can readily check that they have tied it correctly. It is more correctly called the Figure Eight on the Bight, and was originally known as the Flemish Loop.

Alpine Butterfly Knot

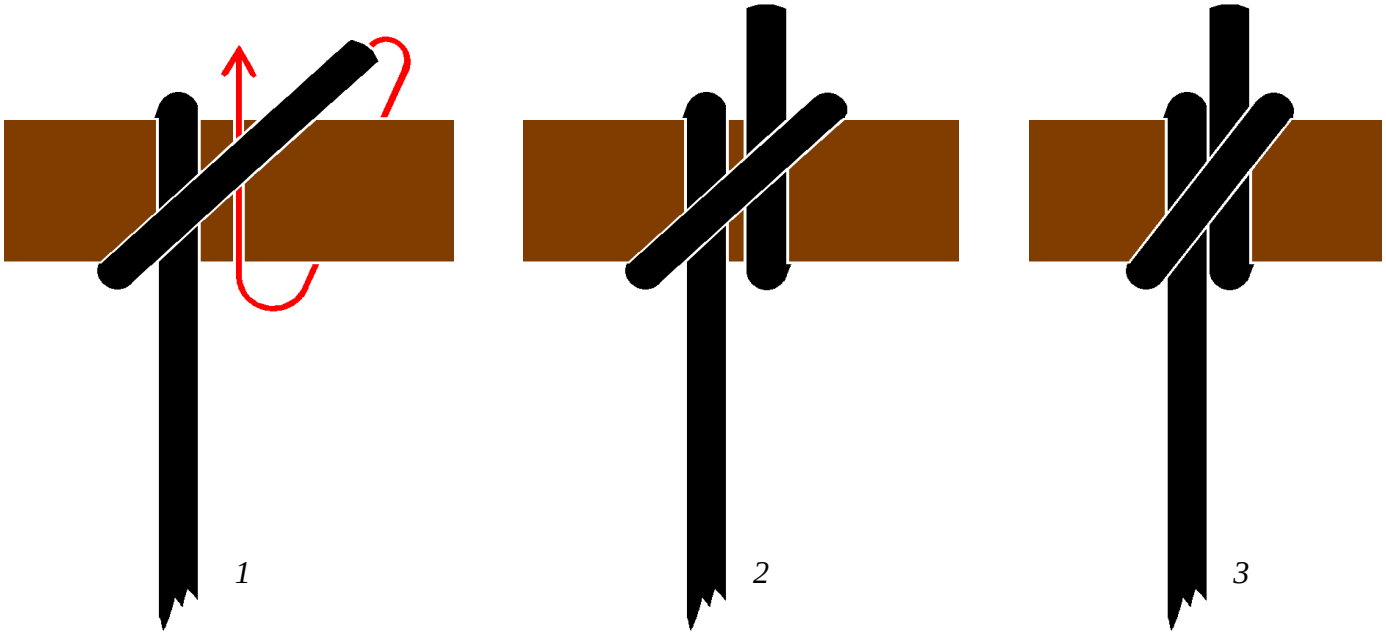
Useful special-purpose loop



- Used to make a single loop some way along a rope, particularly when the loop and the ends could each be pulled in different directions.
- Good for artificial-fibre rope; strong and easy to untie, even when wet and tight. Can be hard to untie in natural-fibre rope.
- Particularly suitable for climbing, such as when a third climber ties into a rope between two others. In such situations, when a 3-way pull is likely, it is better than a Double Figure Eight loop.
- Named for its symmetrical shape. Was once known as the Linesman's Loop.

Clove Hitch

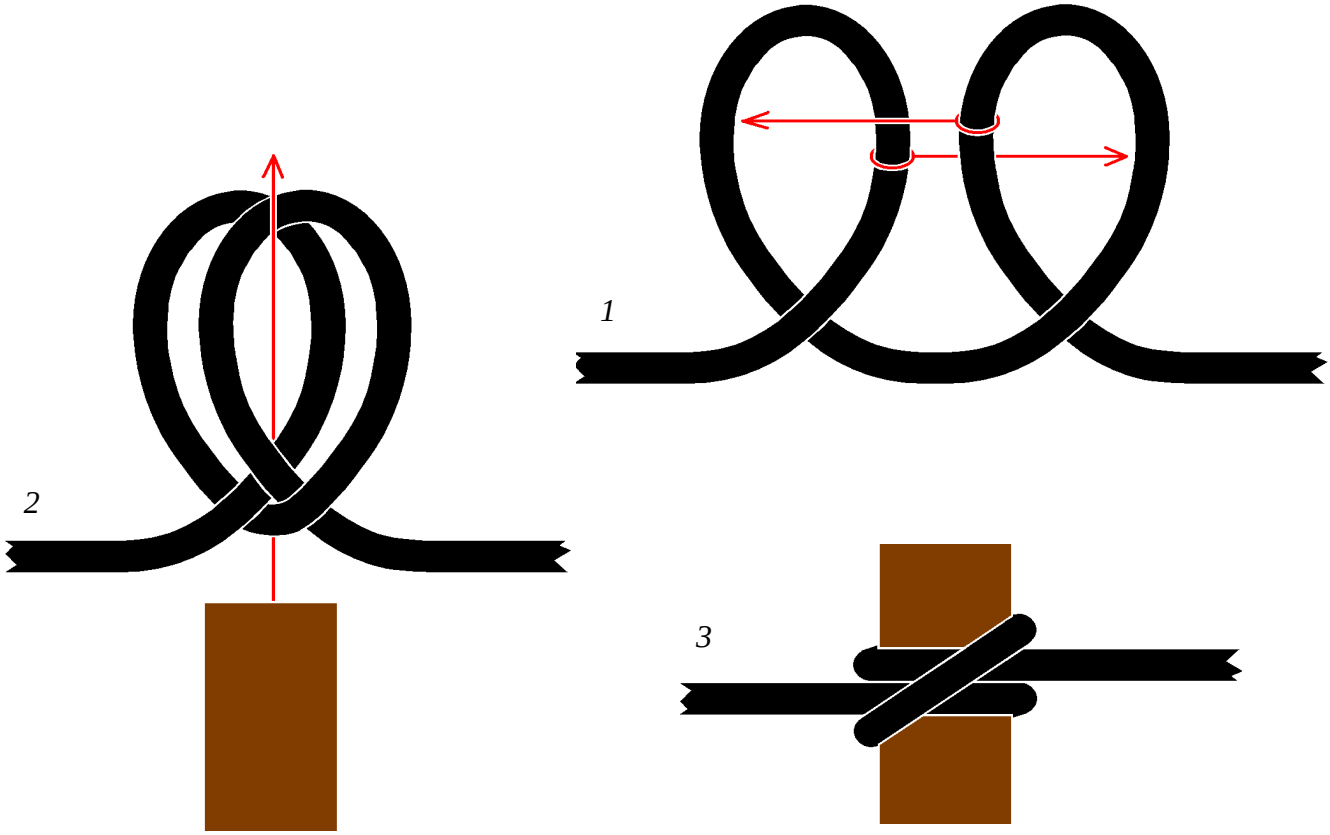
Important general-purpose hitch



- Used for tying a rope at right-angles to a spar or fixed object.
- Good for natural-fibre rope, (strong and easy to untie, even when wet and tight).
- Can be tied when the rope is under tension, though not easily.
- Ideal to tie a rope to a spar, including when starting or finishing a lashing. When starting a lashing, the loose end should be twisted around the main rope before continuing to tie the lashing; this lessens the risk of it loosening.
- The Clove Hitch can be tied in two ways:
  - Either by passing one end around the spar twice, tucking the end under the first pass to finish, (*1*,*2*,*3* above);
  - Or by interleaving two loops to make the knot "in the air", then dropping it over one end of the spar and tightening it, (*4*,*5*,*6* below). This cannot be done when the rope is under tension.
- Not recommended in circumstances where the knot can spill from lack of friction:
  - Where the rope and spar are both slippery (eg artificial-fibre rope around a metal pipe), especially where the rope can flap around;
  - Where the spar is thin (less than twice the diameter of the rope);
  - Where the spar is very thick (more than 10 times the diameter of the rope);

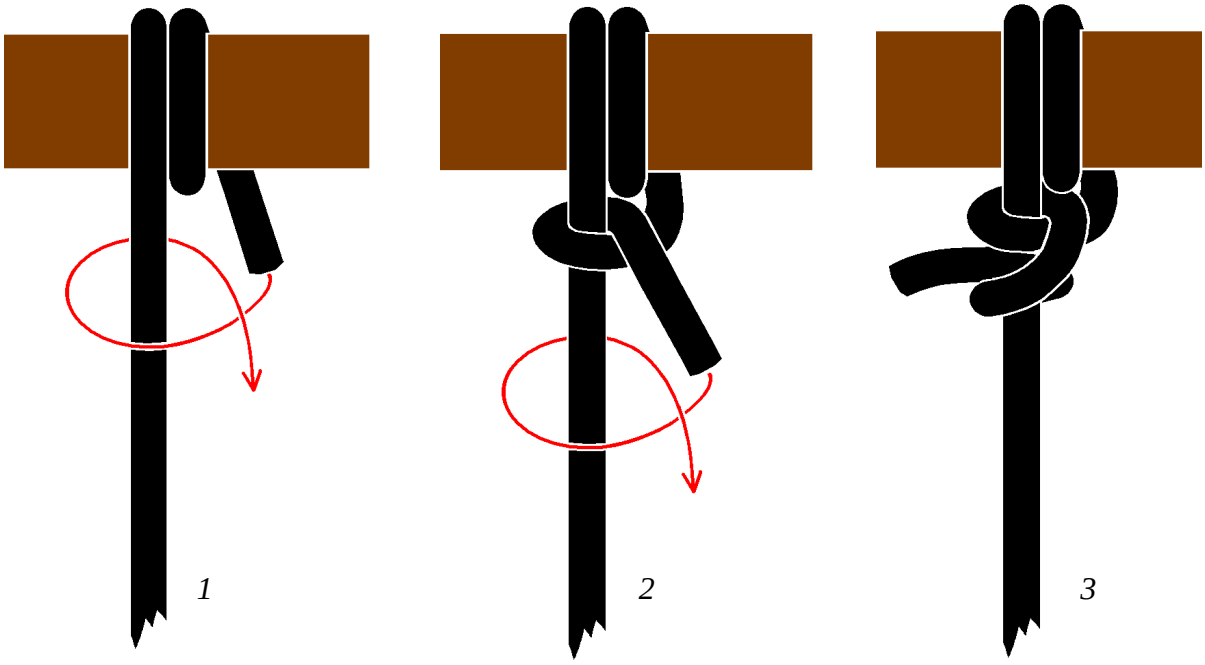
- Where the object has flat sides (eg a square section post);
- If there is any risk of the spar twisting (eg if used to tie rungs on a rope ladder), or that the rope may be pulled in different directions around the spar (eg if an animal can walk around the tree to which it is tied). These actions can "walk" the knot along the rope and eventually off its end.

- Because of these risks of spillage, the Clove Hitch is not recommended for climbing, abseiling, or caving.



Round Turn and Two Half Hitches

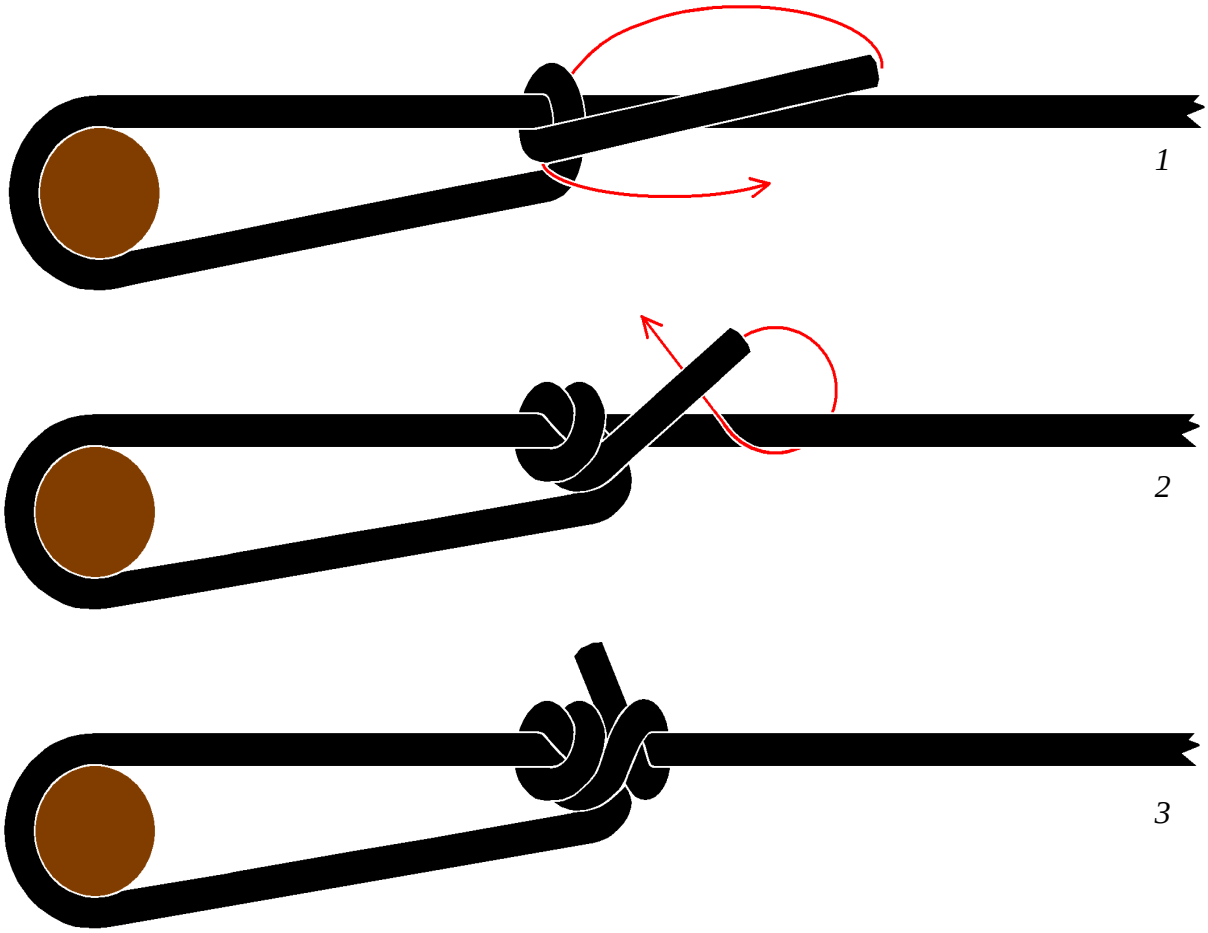
Important general-purpose hitch



- Used for tying a rope at right-angles to a spar or fixed object.
- Can be tied when the rope is under tension.
- Ideal to tie a rope to a smooth, moveable, or irregularly shaped object, because it does not rely on friction between the rope and the object.
- Can be hard to untie in natural-fibre rope, especially when wet and tight.
- When tying the half hitches, the end should keep passing around the standing rope in a consistent direction, (ie to form a Clove Hitch around it). This reduces the tendency of the second half hitch to loosen.
- Can be insecure in slippery stiff artificial-fibre rope, especially where the rope can flap around.

Rolling Hitch

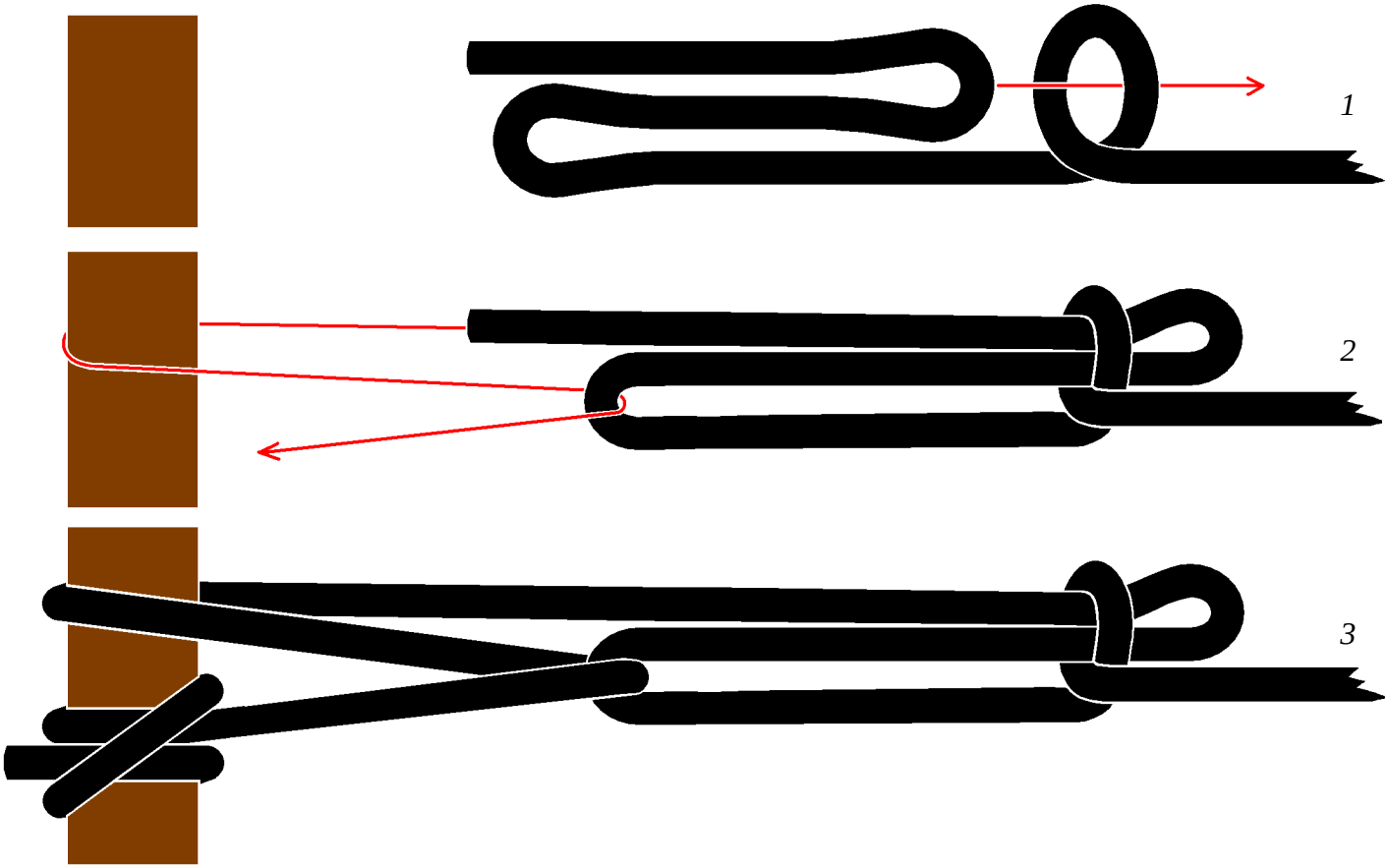
Important general-purpose hitch



- Used for tying a rope to pull at an oblique angle to a spar or another rope under tension.
- Strong and easy to untie, even when wet and tight, but best for ropes that are supple and have lots of friction.
- Especially good to make an adjustable loop to secure a guy-rope around a tent-peg or stake.
- The Rolling Hitch must always be tied under tension. When tying, the second loop should be pulled firmly up over the "shoulder" of the first loop, whereupon the knot will hold itself in place whilst the final loop is tied.
- Sometimes incorrectly called the Magnus Hitch, which differs in that its second turn is not pulled up over the shoulder of the first.

Truckie's Hitch

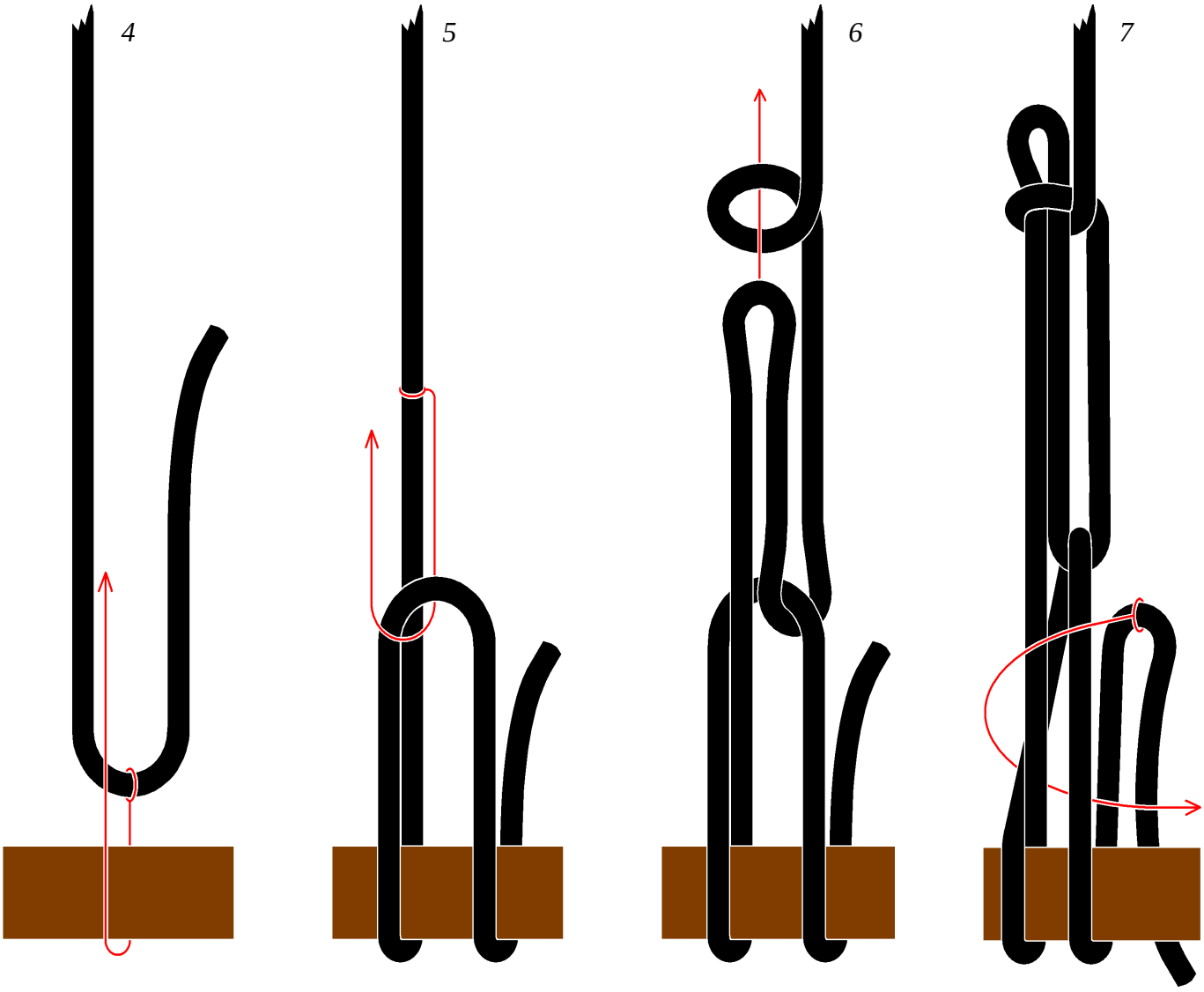
Useful special-purpose hitch



- Used to tie a rope to a fixed object under tension, especially when securing a load onto a truck or trailer.
- Uses a loop in the rope as a "pulley" to double the tension that can be exerted by simply pulling on the rope.
- Not recommended for natural-fibre ropes because of the rope-on-rope friction damage caused when tightening.
- Can be tied in two ways:
  - Either by starting with half a Sheepshank, then threading the end around the tie-down rail and through the loop before tensioning and tying off, (*1,2,3* above);
  - Or "the truckie's method", by passing a succession of bights in the rope through each other, (*4,5,6,7* below).

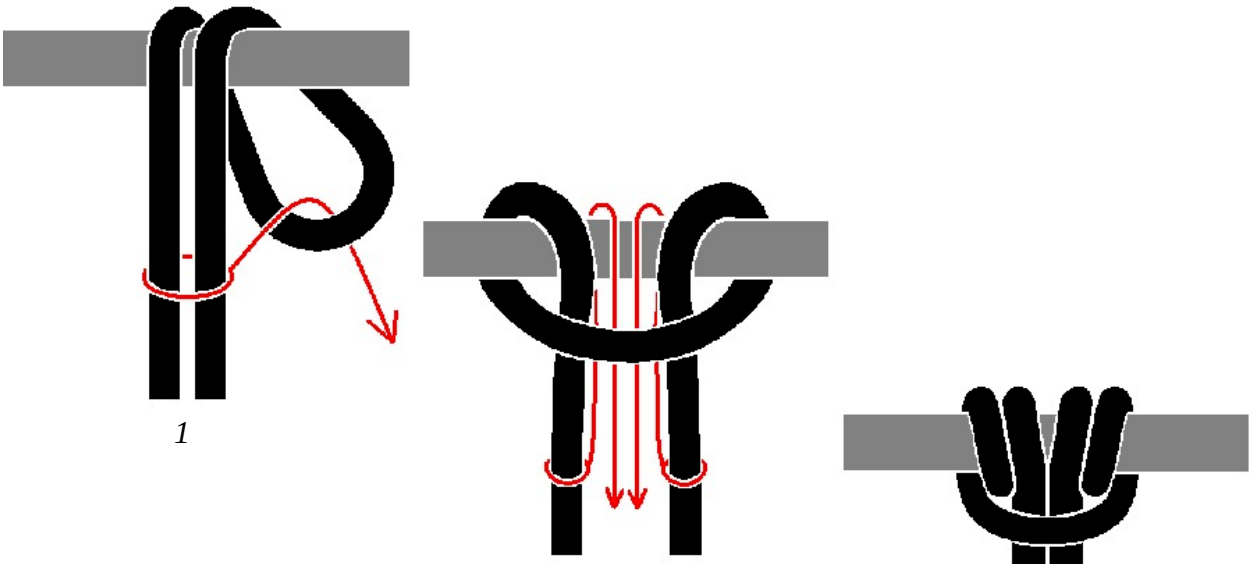
- Once tensioned, the knot can be tied off in any way; a Clove Hitch or Half Hitches are commonly used.

- Named after the blokes who use them most. Originally known as the Hay Hitch.



Prusik Knot

Useful special-purpose hitch



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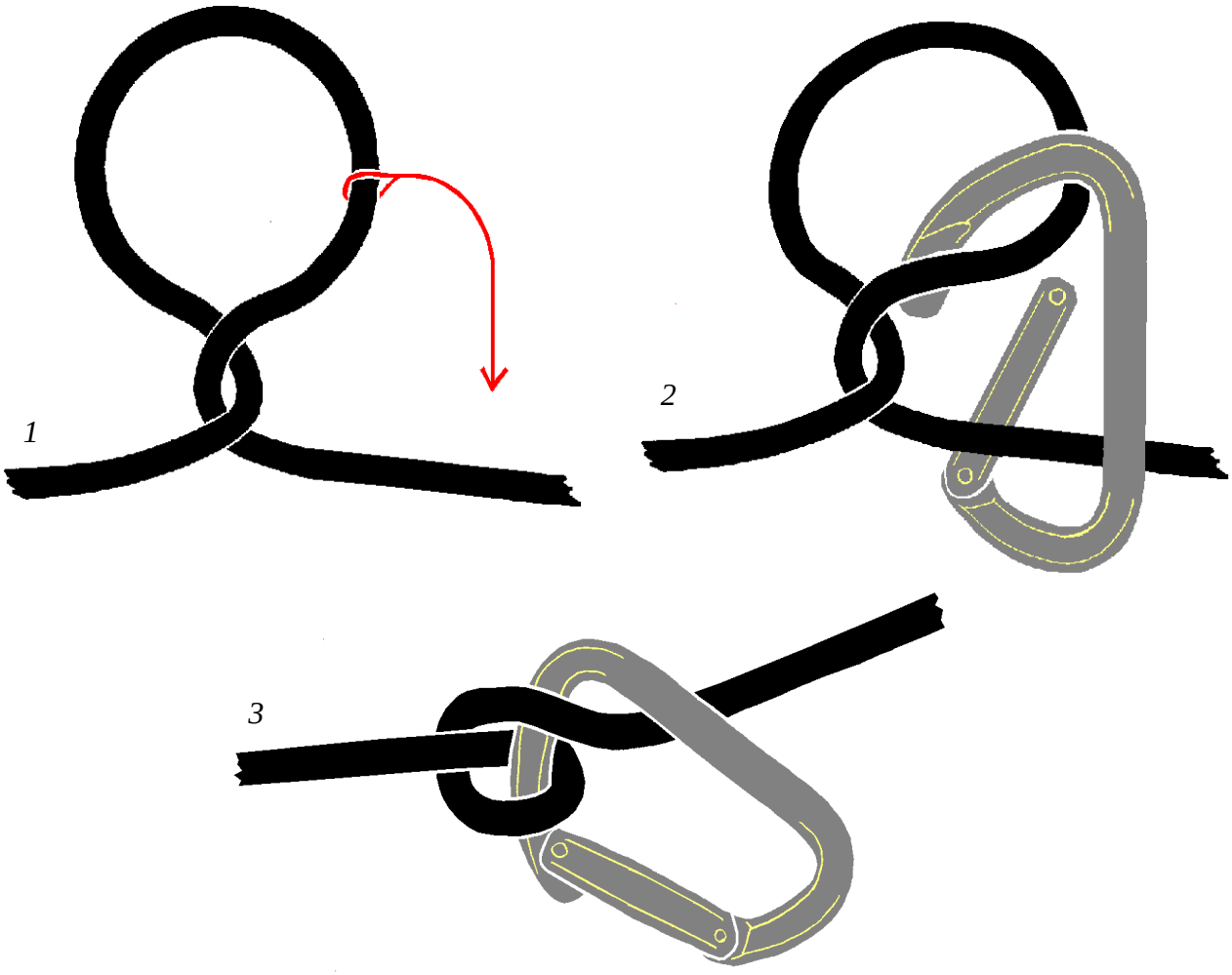
- Used for tying a loop of rope onto a spar, or onto a thicker rope that is under tension.
- The Prusik Knot grips firmly by friction when under tension, but loosens easily when un-weighted.
- For the best friction, the knot should be tied using cord that is smooth, supple, and no more than half the diameter of the rope that it is gripping.
- Most frequently used by climbers, cavers, and abseilers to climb up their main rope (eg to escape from a fall or a crevasse) using two or three small "Prusik loops" that can be alternately slid up the rope, then tighten when load is applied.
- Flagpoles, masts, or spars can be climbed in the same way.
- Also used to attach artificial-fibre ropes to a spar to commence a lashing.
- Must be used with caution:
  - Not suitable to take large loads;
  - Must be loaded gently and steadily. A shock load will cause it to slide down the main rope, generating sufficient heat to melt (and further lubricate) the surface of the loop.
- Named after Austrian mountaineer Dr Karl Prusik who popularised it.

Munter Hitch

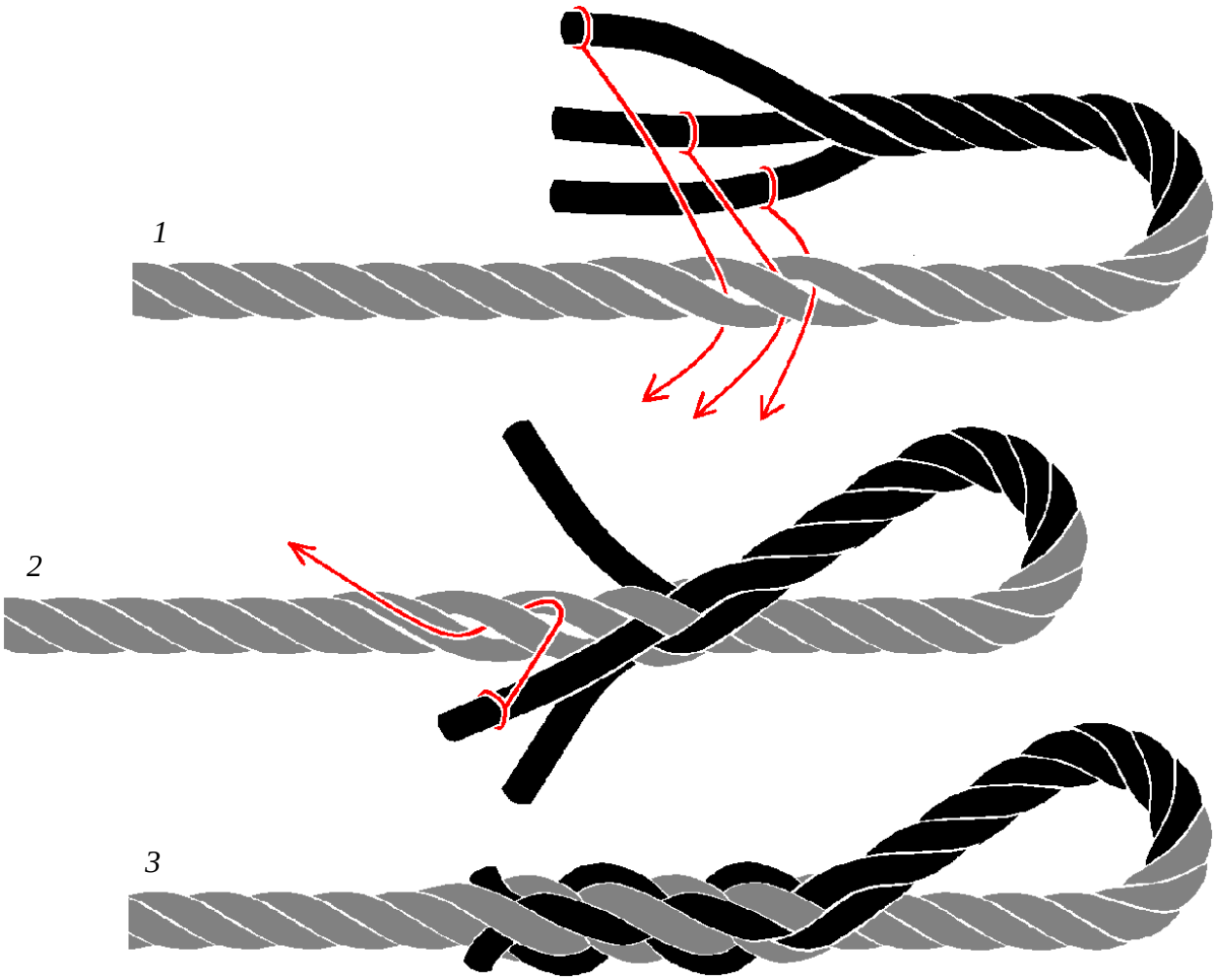
Useful special-purpose hitch



- Used for controlling the rate at which a rope is fed out, especially under tension.
- Widely used by climbers, cavers, and abseilers when belaying and abseiling.
- When not under tension, the rope can be fed easily and rapidly in either direction, but jams effectively to limit a fall when the belayer pulls firmly on the free end.
- Intriguingly, the Munter Hitch is fully reversible; just pull it from the opposite direction.
- Whilst very effective in holding a big shock load, the knot relies on rope-on-rope friction which may damage the sheath.
- Twists the rope when abseiling or lowering a load.
- Normally used on a screw-gate karabiner (pear-shaped), but can be tied around a pole or spar.
- Named after Swiss mountaineer Werner Munter who popularised its use. Also known as the Italian Hitch.

Eye Splice

Important special-purpose loop

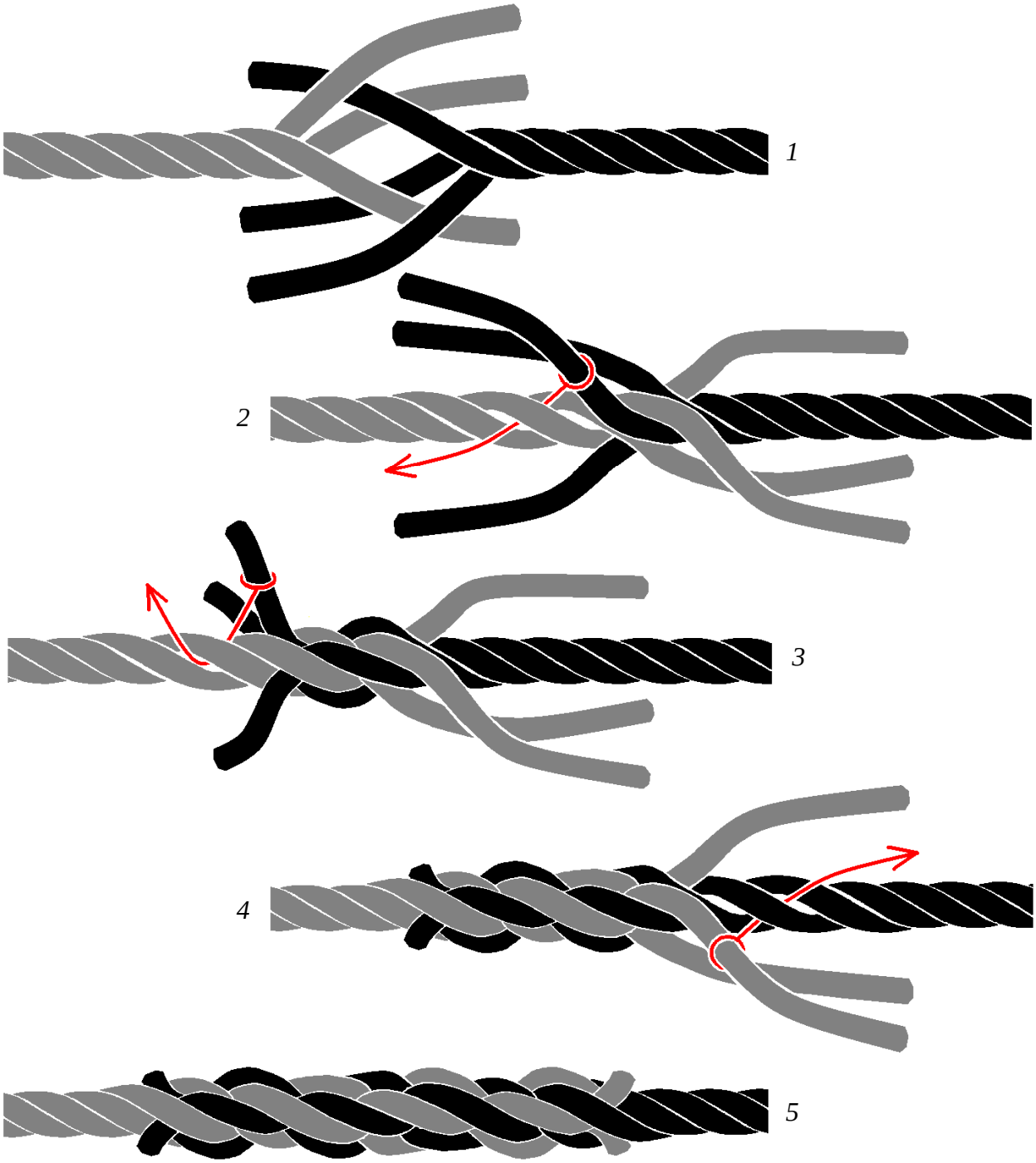


- Used to make a permanent loop in the end of a laid multi-strand rope.
- Is the strongest and least bulky loop knot, and does not come loose. Can be tied in both natural-fibre and artificial-fibre ropes.
- Often used to tie around a metal thimble.
- To tie:
  - Unlay the end of the rope for several turns *(1)*;
  - Tuck each loose strand under a different strand of the standing rope;
  - Tuck one loose strand over one strand of the rope and under the next *(2)*;
  - For each of the other two loose strands, tuck over and under as in the previous step. (After all three loose strands have been tucked, each should protrude from under a different strand of the standing rope);
  - Give all three loose strands one further over-and-under tuck each, (ie repeat the two previous steps).
- Trim the loose ends about one strand's width out from the rope.

- To prevent the rope from further unlaying whilst splicing, twine is sometimes used to tie a Constrictor Knot around the rope. Similarly, to stop individual strands unravelling, bind the tip of each with a Constrictor Knot.
- Even with the most slippery artificial-fibre rope, no extra strength or security is gained by tucking the strands more than three times each.
- To minimise the risk of coming untucked, each strand end of an artificial-fibre rope can be cut with a hot blade and pressed to form a small splayed knob.

Short Splice

Useful special-purpose bend

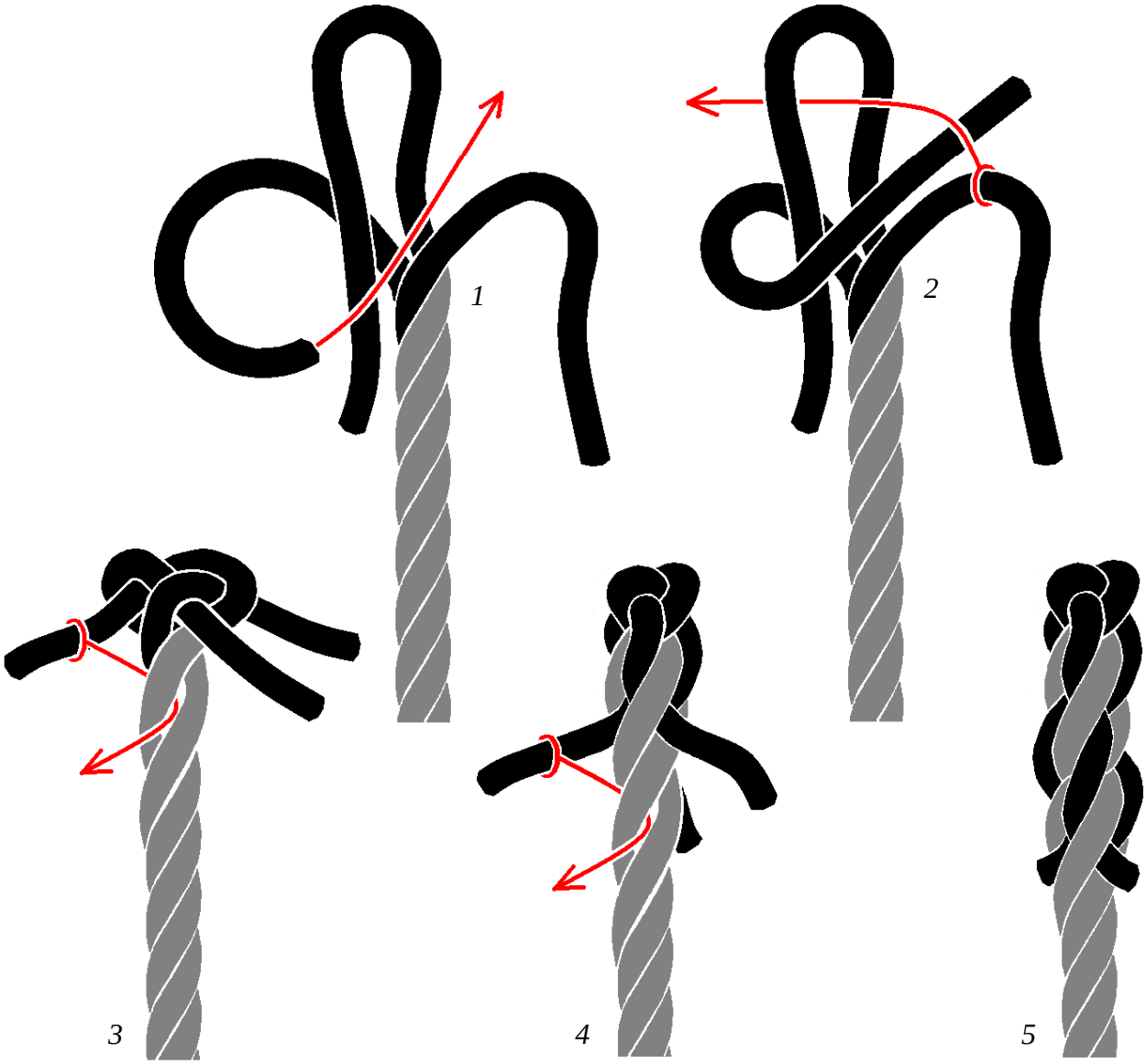


- Used to permanently join the ends of two laid multi-strand ropes.
- Is the strongest way to join two ropes.
- Can be used for both natural-fibre and artificial-fibre ropes, and for joining ropes of (moderately) different thickness.

- To tie:
  - Unlay the ends of each rope for several turns, then "marry" the ends together *(1)*;
  - Tuck one loose strand over one strand of the opposing rope and under the next;
  - For each of the other two loose strands (from the same rope end), tuck over and under as in the previous step. (After all three loose strands have been tucked, each should protrude from under a different strand of the opposing rope);
  - Give each of the same three loose strands one further over-and-under tuck, (repeating the two previous steps).
  - Turn the whole splice end-on-end, then tuck each loose strand from the other rope end, (ie as for the three previous steps);
- Trim the loose ends about one strand's width out from the rope.
- To hold the ropes together whilst splicing, twine is sometimes used to tie a Constrictor Knot around all six strands where the two ropes join after marrying them. Similarly, to stop individual strands unravelling, bind the tip of each with a Constrictor Knot.
- Even with the most slippery artificial-fibre rope, no extra strength or security is gained by tucking the strands more than twice each.
- To minimise the risk of coming untucked, each strand end of an artificial-fibre rope can be cut with a hot blade and pressed to form a small splayed knob.
- Named to distinguish it from the Long Splice, which is less bulky but (you guessed it) longer.

Back Splice

Useful special-purpose stopper knot

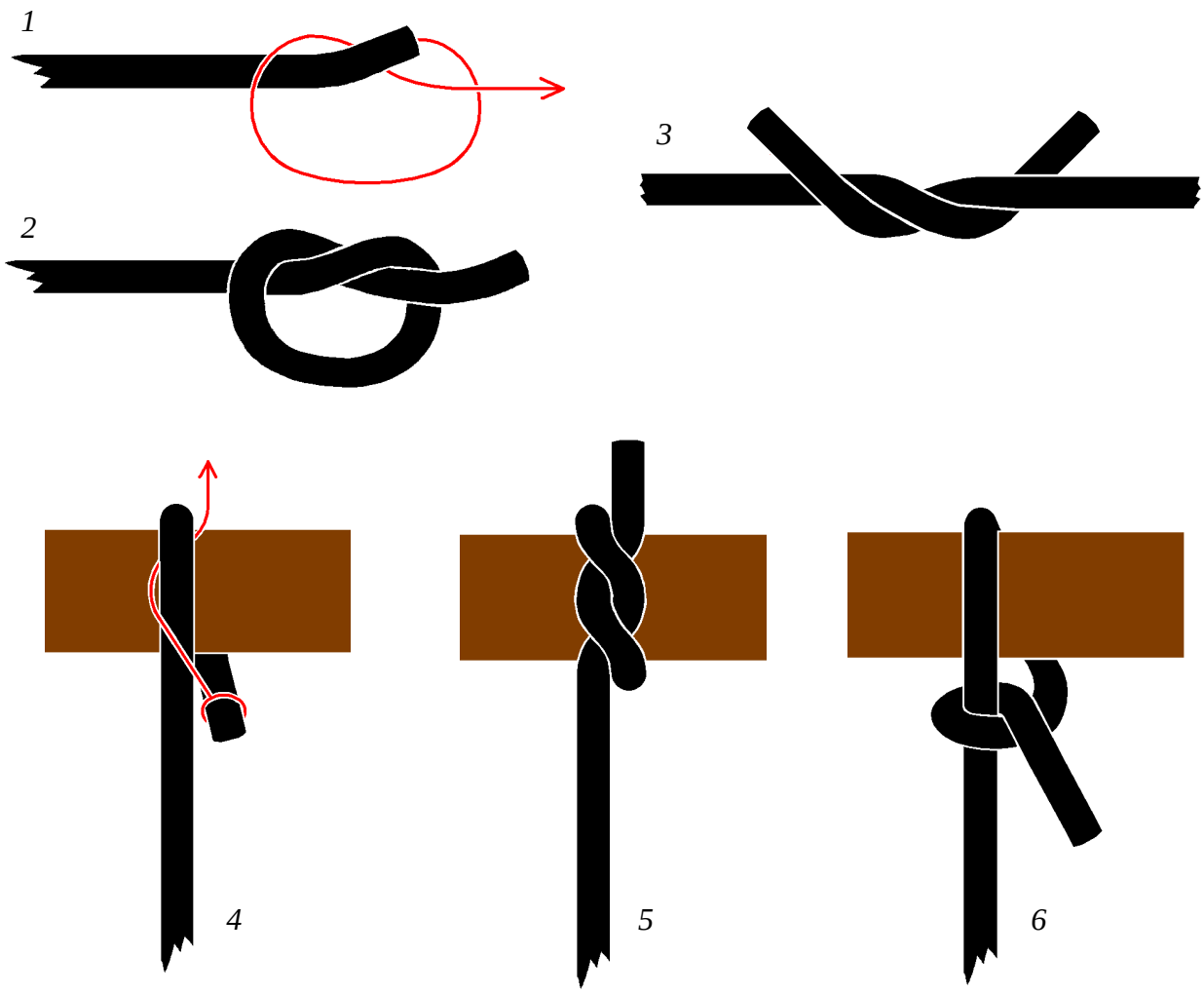


- Used to prevent a laid multi-strand rope from fraying and unravelling.
- Can be used for both natural-fibre and artificial-fibre ropes.
- To tie:
  - Unlay the ends of the rope for several turns;
  - Using the unlaid strands, tie a Crown Knot in the end of the rope *(1,2);*
  - Tuck one loose strand over one strand of the rope and under the next *(3)*;
  - For each of the other two loose strands, tuck over and under as in the previous step. (After all three loose strands have been tucked, each should protrude from under a different strand of the standing rope);
  - Give all three loose strands one further over-and-under tuck each, (ie repeat the two previous steps).

- Trim the loose ends about one strand's width out from the rope.
- To ensure that the Crown Knot is firm, twine is sometimes used to tie a Constrictor Knot around the rope before tying it. Similarly, to stop individual strands unravelling, bind the tip of each with a Constrictor Knot.
- Even with the most slippery artificial-fibre rope, no extra strength or security is gained by tucking the strands more than twice each.
- To minimise the risk of coming untucked, each strand end of an artificial-fibre rope can be cut with a hot blade and pressed to form a small splayed knob.
- Whilst a Back Splice can be tied quickly and without twine, a whipping is usually preferable. A Back Splice can be less easily threaded through a pulley or an eyelet (eg in a tarpaulin), and it snags irritatingly when tying knots or resolving a tangle.

Overhand Knot

Important basic knot component



- Used as a basic component of complex knots, or to tie off the loose end a rope to make a knot more secure, (usually doubled or in pairs).
- Can be tied “in the air”, (making a simple loop), or around a rope or spar.
- When tied “in the air” and tightened (*1*,*2*), it is referred to as the Overhand Knot or Thumb Knot:

- This can be useful when tied in the end of a rope or cord to stop it fraying or unravelling, or as a “stopper knot” to prevent a rope from escaping through an eyelet or pulley;
- Very hard to untie when wet or tight, and can weaken the rope by up to 50%.

- The Overhand Knot is also used as a component of more complex knots:
  - When tied to join two pieces of rope (*3*), it is referred to as the Half Knot (ie half of a Reef Knot), or as the Overhand Knot.
  - When tied around a spar or another rope, it is referred to as an Overhand Knot or Half Knot (*4*,*5*), or a Half Hitch (*6*).
- When tied "in the air", the Overhand Knot can be doubled by passing the end through the loop for a second time (*7*,*8*):
  - This makes the knot easier to untie, and makes a better "stopper knot" because it is bulkier;
  - Tied in the cords of a "cat-o'-nine-tails" whip, it was known as the Blood Knot; (very useful in scouting).
- Tied around a rope (*9*), the Double Overhand Knot becomes an excellent way of securing loose ends to stop a bend or loop knot from coming untied, (eg when climbing). It is easy to untie.

Double Overhand Knot

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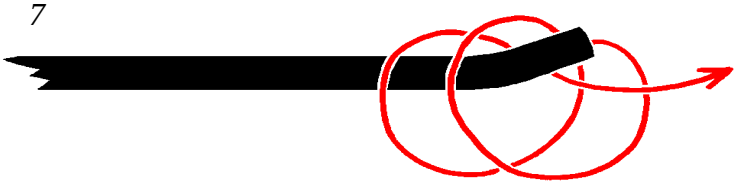

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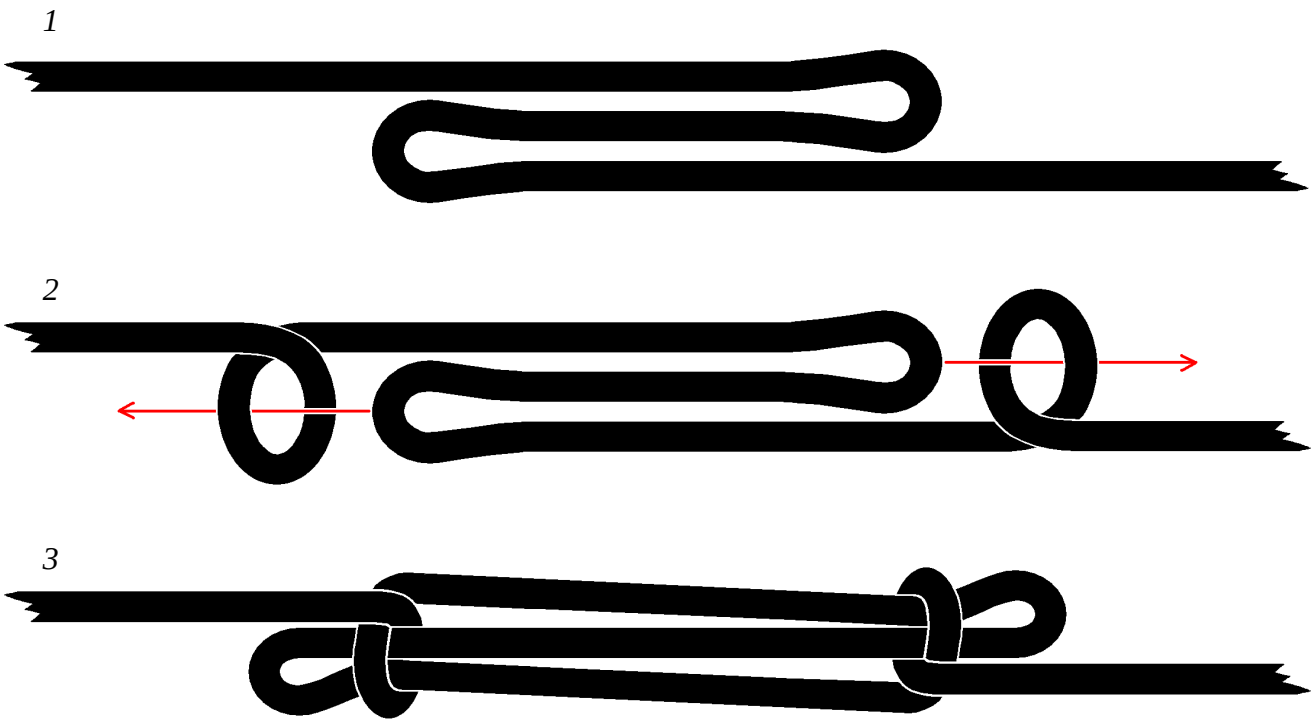
Sheepshank

Interesting curiosity



- Supposedly used to shorten a rope, or to strengthen a weak section of rope, but I have never known it to be used in real life.
- It is actually less strong than a mildly damaged rope, since any knot significantly weakens the rope in which it is tied.
- Required learning for generations of Scouts “because it’s good for you”, (like studying Latin).
- Is partly used when tying the Truckie’s Hitch.